SECTION 3 CONTENTS

INTRODUCTION

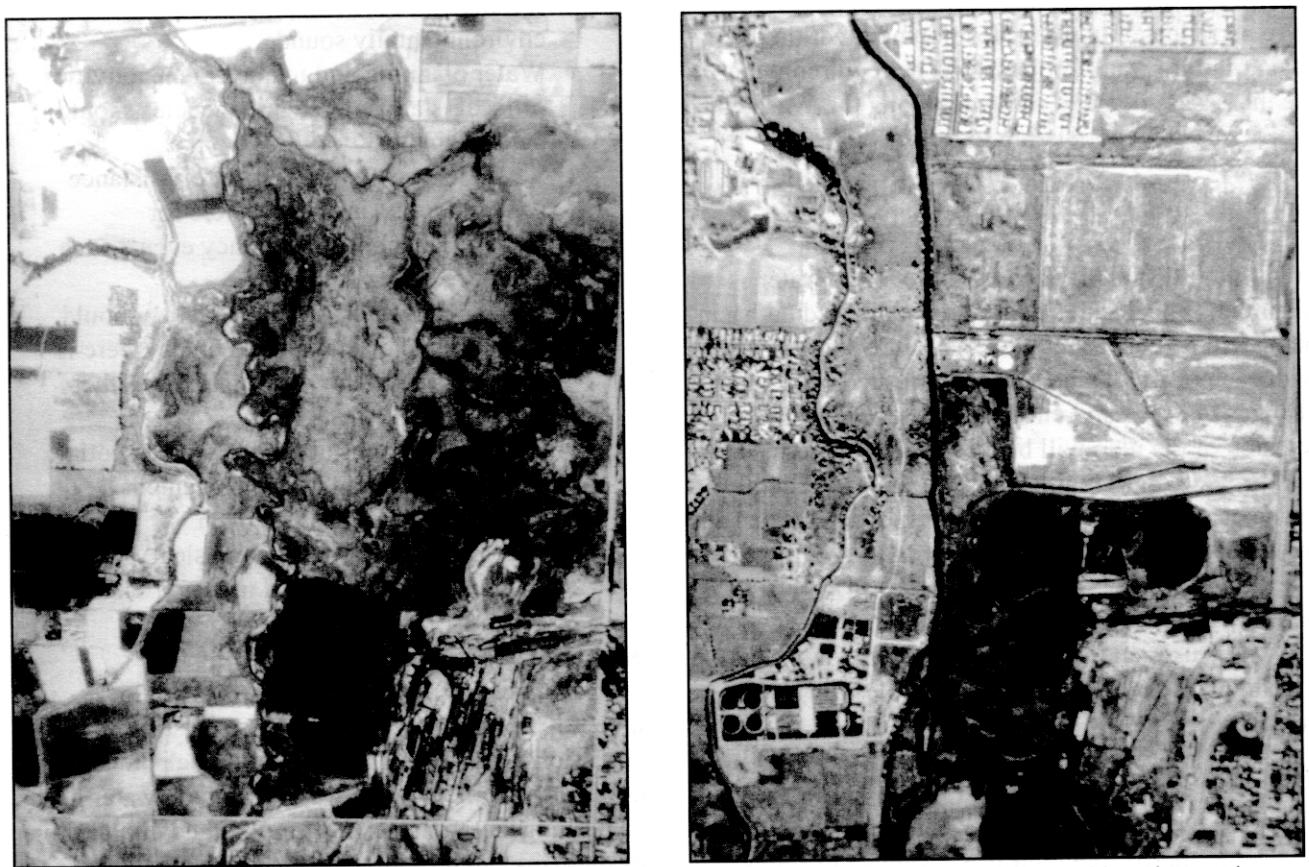
An orderly process is needed to describe the planning, conservation and development of water resources. It should provide the flexibility to adjust as future conditions change.

3.1 Background

This section includes some general planning guidelines and the organizational arrangements used in preparing the basin plan. It also includes a general physical description of the Jordan River Basin (Salt Lake County).

The Board of Water Resources and the Division of Water Resources have a leadership role in water planning and development, and in coordinating water planning activities with the other state and federal agencies. Formulation of basin plans fits within the state water policy framework which includes regulation, water rights, conservation, development, protection of water quality and management. Municipal and industrial (M&I), agricultural, fish and wildlife, and recreational uses are all included in the planning process. The inter-relationship of water resources demands and activities are recognized and incorporated.

The *Jordan River Basin Plan* includes a description of significant water problems, options available to resolve them and recommendations for future action. One main purpose is to identify problems which need early attention. Each



Aerial photos of the Jordan River between 6800 South and 7800 South, taken in 1937 (left) and in 1990, reveal how the river has been straightened and vast areas of wetlands filled in for agricultural and industrial developments. For further site reference, note the North Jordan Canal that appears on the left side of both photos.

recommendation addressing an identified need is consistent with the state water policies identified in the *1990 State Water Plan.*

Previous water-related studies conducted by state and federal agencies in the Jordan River Basin have provided important information on the resources and, in some cases, alternative water development plans. The studies used in preparing this report are listed by number in Section B.

The *Jordan River Basin Plan* is prepared at a reconnaissance level, with a general assessment of problems and demands, and their location. Basin planning is a continuous process, and the plan is flexible to allow for future revisions. Water management, protection of water quality, and conservation needs are delineated, and all potential uses are considered. It is intended that the formulation and implementation of a basin plan will provide a balance of environmental, economic, social and political factors.

Over the years, many water supply projects have been built by private individuals, (non-profit) irrigation companies, incorporated municipalities and other water users. The state and federal government have participated in water development within the basin. Future water projects will be required due to the increasing demand for water along the Wasatch Front caused by population increases.

3.2 Planning Guidelines

The *State Water Plan* describes the basic premises and lays the foundation for state water planning. This insures continuity so individual basin plans will be consistent with the statewide plan and with each other. To be flexible and accommodate changes in needs and circumstances, review and revision of the plan will be a continual process. This will provide opportunities for all state and federal agencies, local government entities, organizations and individuals to present their concerns.

3.2.1 Principles

Many uses and interests are involved in preparing a basin plan. Certain guiding principles are also considered, namely:

- All waters, whether surface or subsurface, are held in trust by the state as public property, and their use is subject to rights administered by the State Engineer. The prior appropriation doctrine has governed Utah water law since before statehood.
- Water is essential to life. Utah residents have the responsibility to maintain or improve water quality to meet the needs of the generations that will follow.
- The diverse present and future interests of Utah's residents should be protected through a balance of economic, social, aesthetic and ecological values.
- Public water uses for which it is difficult to identify specific beneficiaries, such as recreation and aesthetics, should be included in the water planning and development process.
- Public input is vital to water resource planning.
- All residents of the state are encouraged to conserve water and implement wise water use practices.
- Water rights owners are entitled to transfer their rights under free market conditions.
- Water resource projects should be technically, economically and environmentally sound.
- Water planning and management activities of local, state and federal agencies should be coordinated.
- Local governments, with state assistance as appropriate, are responsible for protecting against emergency events such as floods and droughts.
- Designated water uses and quality should be improved or maintained unless there is evidence the loss is outweighed by other benefits.
- Educating Utahns about water is essential. Effective planning and management requires a broad-based citizen understanding of water's physical characteristics, potential uses and scarcity.

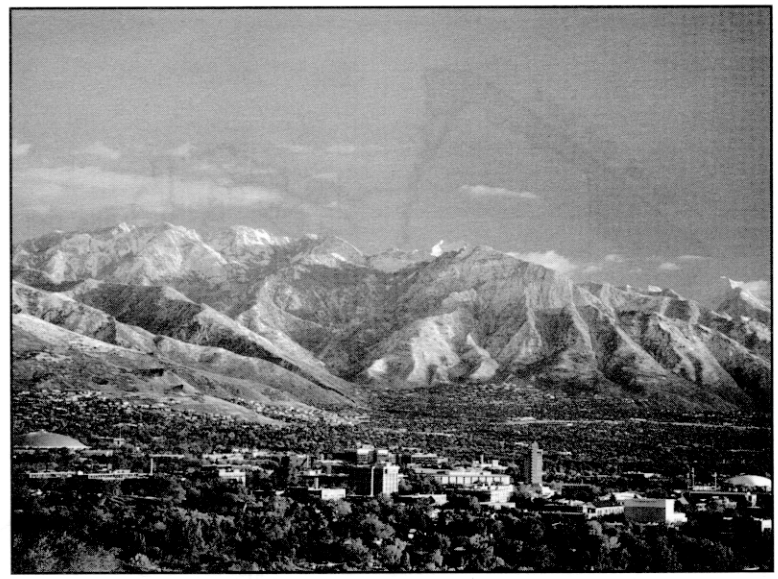
3.2.2 Purpose

The main purpose of this basin plan is to inventory existing resources, assess existing conditions, identify issues, and describe potential development alternatives for meeting the water needs of future generations. The *State Water Plan* and river basin plans can provide guidance and help coordinate

the planning efforts among all state, federal and local entities and be the vehicle to involve concerned parties.

3.2.3 Organization

State water planning is the responsibility of the Division of Water Resources under policy guidelines of the Board of Water Resources. With this in mind, a state water plan coordinating committee representing 12 state agencies facilitated preparation of the *Jordan River Basin Plan.* A steering committee consists of the chair and vice chair of the Board of Water Resources, the executive director of the Department of Natural Resources, and director and assistant director of the Division of Water Resources. The local board member is also invited to participate. This committee provided policy guidance, resolved issues, and approved this plan prior to acceptance by the Board of Water Resources.



Salt Lake Valley - University of Utah and Wasatch Mountains

In addition, federal and other state agencies participated as cooperating entities. These agencies have particular expertise in various fields to assist with plan development. Also, a statewide local advisory group representing various organizations and special interest groups has assisted with input and plan review. This group represents a spectrum of various interests and geographical locations.

A local basin planning advisory group for the Jordan River Basin provided input by way of advice, review and decision making. Most of the members of this group reside within or are directly involved in basin affairs. They represent various local water interests and provide geographical representation within the basin.

3.2.4 Process

During the review and approval process, four drafts of the *Jordan River Basin Plan* were prepared. They were 1) in-house, 2) committee, 3) advisory, and 4) public review drafts. After this process, the final basin planning report is distributed to the public for information and use. Public involvement is an important part of the planning process, and is necessary to assess actual viewpoints and conditions in the basin. The opportunity for public discussion and input has been and will continue to be provided at the local, state and federal levels as plan formulation moves through various phases.

3.3 Description of Basin

The Jordan River Basin is unique in Utah because of the number of people drawing from the existing water supply. To better understand the problems, alternatives and recommended actions, a brief description of the basin's physical characteristics is presented.

The total area drained by the Jordan River includes the Jordan River Basin and the Utah Lake Basin. The Jordan River/Utah Lake Basin, located in north central Utah, is shown in Figure 3-1. The Jordan River Basin as defined herein includes all of Salt Lake County. The Utah Lake Basin includes all lands draining to Utah Lake as well as the portion of the Jordan River from Utah Lake to the Salt Lake County line. This report only addresses water issues for the Jordan River Basin (See Figure 3-2).

3.3.1 Drainage Area and Topography

The Jordan River/Utah Lake Basin includes all of the rivers and streams tributary to Utah Lake and numerous tributary mountain streams which drain directly into the Jordan River. The largest of these tributary streams, and the major source of flow to Utah Lake and the Jordan River, are the Provo and Spanish Fork rivers.

The headwaters of the Provo River, and hence the primary headwaters for the Jordan River/Utah Lake

Figure 3–1

LOCATION MAP
Jordan River/Utah Lake Basin

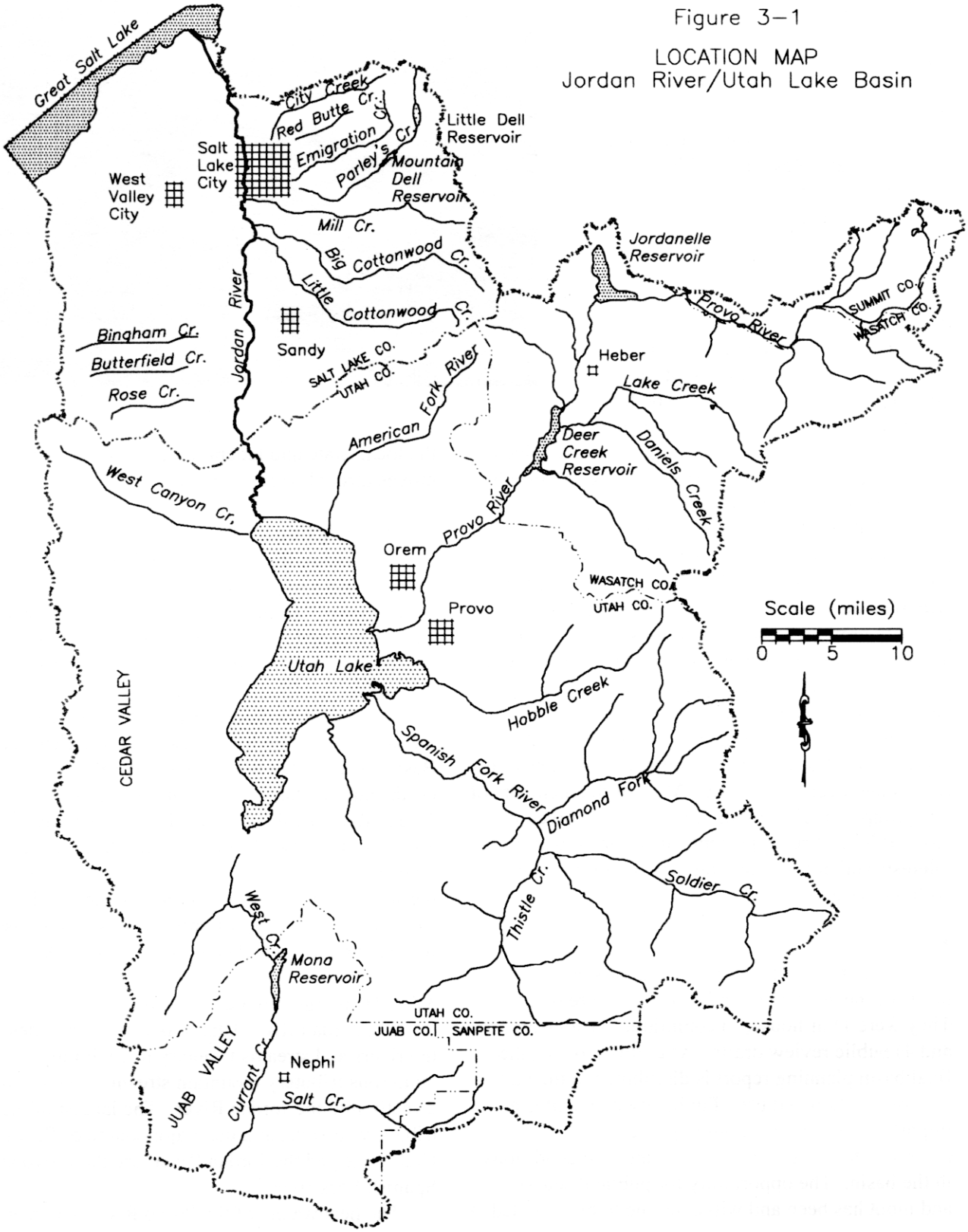
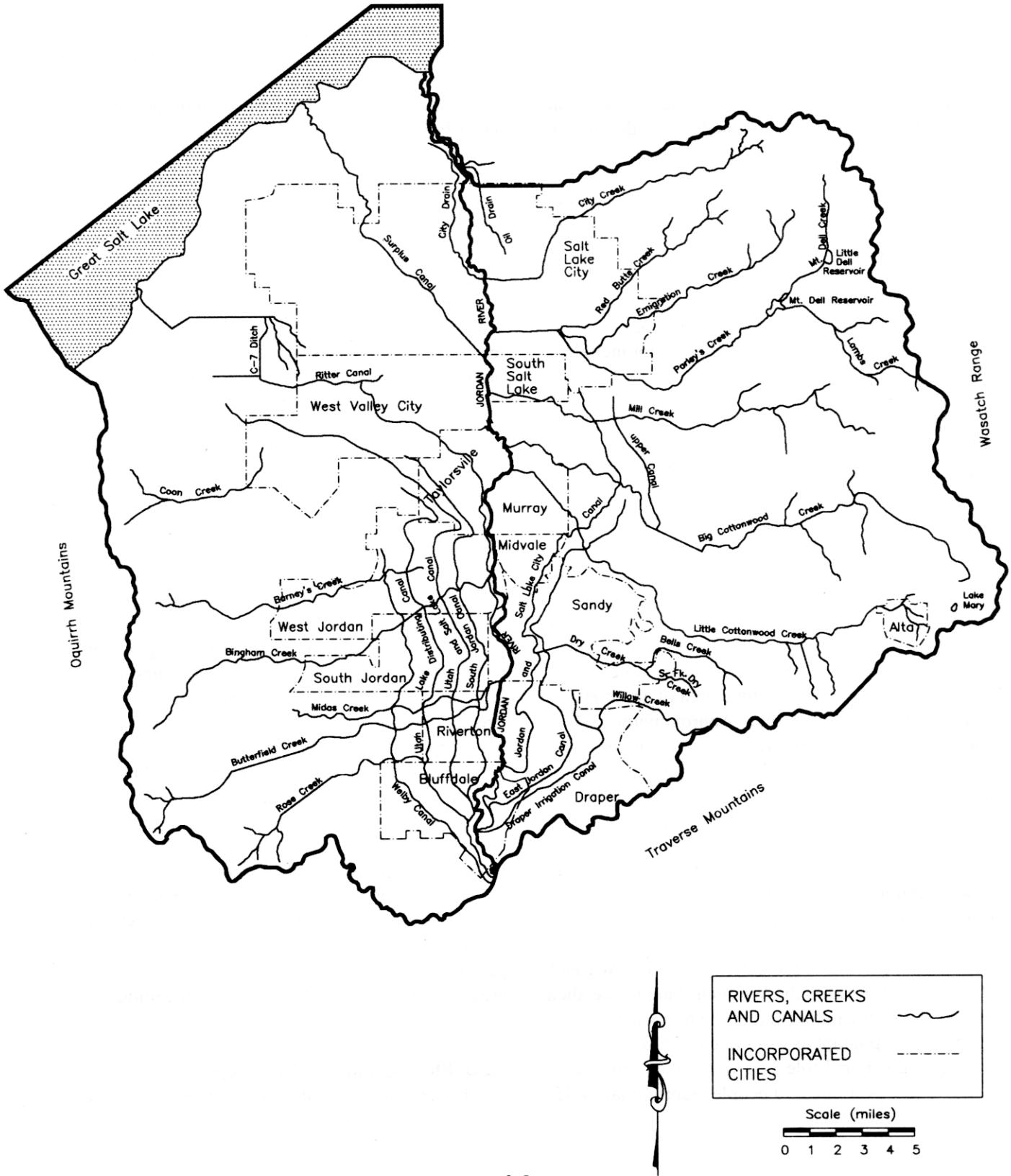


Figure 3-2

LOCATION MAP
Jordan River Basin



Basin, are located approximately 50 miles east of Salt Lake City in the western end of the Uinta Mountains in Wasatch County at elevations approaching 11,000 feet. In the upper reaches of the river, numerous small glacial lakes serve as catchment areas for the heavy snowfall and rain.

The Provo River drains approximately 673 square miles of primarily mountainous and forested land which, except for the settlements in Heber Valley and Utah Valley, is sparsely populated. The other major drainage which contributes significant flows to Utah Lake is the Spanish Fork River which drains 652 square miles of mountainous and forested region in the southeast corner of the basin. Small basins to the west and south of Utah Lake are Cedar Valley, northern Juab Valley and Goshen Valley. These areas, along with other Utah Lake tributary streams, are discussed in the *Utah Lake Basin Plan.*

The Jordan River is 44 miles long (not including meanders) and flows north from the outlet of Utah Lake to the Great Salt Lake. It is also fed by seven major tributary streams (Little Cottonwood Creek, Big Cottonwood Creek, Mill Creek, Parley's Creek, Emigration Creek, Red Butte Creek and City Creek) and 13 smaller streams which originate in the Wasatch Range on the east side of Salt Lake County. These furnish more than 97 percent of the surface water supply in the valley. Six other streams, which originate in the Oquirrh Mountains on the west side of the valley such as Bingham Creek and Butterfield Creek are intermittent and ephemeral in nature and supply less than 3 percent of the surface water.

Salt Lake County has a total area of about 805 square miles (515,200 acres). Approximately 370 square miles are in the extremely mountainous and heavily forested Wasatch Range, Oquirrh Mountains and Traverse Mountains. With the exceptions of Emigration, Big Cottonwood and Little Cottonwood canyons, the mountainous areas are almost entirely uninhabited. Although there is very little residential or agricultural land use in the mountainous portions of the county, there are significant mining interests (particularly in the Oquirrh Mountains) along with a tremendous amount of recreational activity (Wasatch Range). Additionally, the Wasatch Range watersheds provide a significant portion of the municipal water supply. A topographical summary of Salt Lake County is given in Table 3-1. Salt Lake County is home to just over 800,000 people, approximately 45 percent of Utah's total population, residing primarily in 14 incorporated cities (Salt Lake City, South Salt Lake City, West Valley City, Sandy, Taylorsville, Murray, Midvale, Taylorsville, Draper, West Jordan, South Jordan, Riverton, Bluffdale and Alta). A significant population also lives in the unincorporated areas of the county. Much of the residential expansion is occurring on irrigated agricultural lands in the southwest portions of the valley.

Utah Lake, which lies just south of the Jordan River Basin, is used as a reservoir. It has an active capacity of 710,000 acre-feet and a total capacity of 840,000 acre-feet at compromise. Utah Lake is nearly 300 feet higher than the Great Salt Lake, and the outflow from Utah Lake is the Jordan River.

3.3.2 Climate

The Jordan River Basin climate is typical of mountainous areas in the west; wide ranges in temperature between summer and winter, and between day and night. The high mountain regions experience long, cold winters and short, cool summers. The lower valleys are more moderate with less variance between maximum and minimum temperatures. As part of the Great Basin Region lowlands, the Jordan River Basin is classified as semi-arid.

The Jordan River Basin experiences four distinct seasons with a major portion of the precipitation occurring as snow during the winter months and producing high runoff during the spring snowmelt periods. Normal annual precipitation ranges from 12 to 16 inches on the valley floor to 60 inches in the high mountain areas of the Wasatch Range. Precipitation in the lower elevations during the May-September growing season is only 5 to 6 inches, compared to a crop water requirement of 20 to 30 inches. A portion of the precipitation on mountain ranges is absorbed into the soil and underlying bedrock during the runoff periods, providing recharge to the valley groundwater reservoir.

Temperatures in the valley have ranged from -30°F in the winter to 110°F in the summer. Water surface evaporation in the valley averages 42 inches per year. The average frost-free season for the valley area is approximately 200 days from the middle of April to the end of October.

3.3.3 Physiography and Geology

The Jordan River Basin forms part of the eastern edge of the Basin and Range Physiographic Province

Table 3-1
TOPOGRAPHY
Salt Lake County

	Area (square miles)
Mountains (>5200')	370
Water (including Great Salt Lake)	26
Valley (<5200')	409
Total	805

bounded on the east by the Wasatch Range of the Middle Rocky Mountains. The huge fault block mountains surrounding Salt Lake Valley stand as evidence of massive earth shifts in the past, and the Wasatch Fault exists today as a constant reminder of the areas turbulent past. In times of greater humidity and glacial activity, ancient Lake Bonneville covered over 20,000 square miles with a water level 1,000 feet above the present elevation of the Great Salt Lake. As the lake receded, it left wave cut terraces on the lower slopes of the mountains and deposits of sand and gravel in the valley.

The basin is bounded on the east by the Wasatch Range which rises abruptly from the valley's edge (approximately elevation 5,200) to 11,000+ feet above sea level. The Wasatch Range intercepts the moisture bearing westerly winds, providing the bulk of the valley's vital water supply. The Traverse Mountains form the valley's southern barrier. The western edge of the valley is bordered by the Oquirrh Mountains, whose peaks rise to 9,000-10,000 feet. To the northwest lies the Great Salt Lake, and beyond that the Great Salt Lake Desert.

3.3.4 Soils and Vegetation

The soils of the upper valleys, above elevation 5,200 (the highest level of ancient Lake Bonneville), have developed from alluvial sediments on flood plains, alluvial fans, and foot slope areas at the base of the mountains. Quartzite and sandstones are the predominant parent material for the alluvium found in the upper valleys. Being so near the source of parent materials, the valley fill in the upper valleys consists mainly of coarse sands and gravels, although there are areas of medium to fine textured topsoils.

Valley soils have developed from sediments deposited in ancient Lake Bonneville. Much of the soil is medium to coarse-textured material deposited at the edges of the valleys as fans. The lake terraces and finer materials widely distributed on the broader interior valley floor were deposited during Bonneville Lake and post-Bonneville Lake times. As a result, a complex pattern of highly stratified soils exists.

In general, arable lands of the basin have good water transmission properties and adequate moisture-holding capacity which, with other favorable physical and chemical properties, make them well- suited for irrigated agriculture.

As elevation varies from 4,200 to 11,000 feet, and precipitation varies from 12 inches to 60 inches, so also does vegetation vary. Heavy alpine forests above about 8,000 feet give way to oaks, mountain brush and juniper trees, then to sagebrush, sparse grasses, scattered vegetation and semi-desert conditions at lower elevations. About 30 percent of the county is forested with either alpine/conifer/aspen or oaks, with 27 percent falling into the closely related categories of mountain-brush, juniper, sagebrush, greasewood or native vegetation types. An additional 9 percent of the basin is classified as open water, riparian, marsh-land or wetlands. See Table 3-2 for a detailed breakdown of the various vegetative cover types and land use.

3.3.5 Land Ownership And Use

Most of the land in Salt Lake County, especially in the valley, is privately owned. Although Salt Lake City owns and manages 24,000 acres of the upper watershed, most of the lands in the upper watershed are managed by federal agencies. The biggest federal land manager is the Forest Service that administers 91,933 acres of national forest lands in the Wasatch Range. The next largest land holding federal agency is the U.S. Army which controls 13,988 acres around Camp Williams in the southern end of the valley. The only other significant federal land holding is

2,896 acres of public domain managed by the Bureau of Land Management (BLM). The state of Utah has scattered land holdings of 9,778 acres. The state also owns the beds of all navigable streams and lakes. See Table 3-3 and Figure 3-3 for the general pattern of Salt Lake County land ownership and administration.

The general pattern of land use as shown on Figure 3-4 reveals that lands for residential, commercial, industrial and agricultural uses are confined almost exclusively to the valley. The exceptions are industrial development in Bingham Canyon in the southwest portion of the valley, residential development in Emigration Canyon to the northeast, and limited residential development in Big and Little Cottonwood canyons in the southeast. Approximately 32 percent has been developed: residential, 17.2 percent; commercial and industrial, 4.5 percent; and agricultural, 10.3 percent. One detail not apparent from the land use map (Figure 3-4) is that recreational use is made of almost all of the canyon and mountainous areas on the valley's east side. Most heavily used are Big and Little Cottonwood canyons, both of which have world class ski resorts and spectacular vistas that attract people on a year-round basis. Also receiving heavy usage are Mill Creek Canyon with its developed day-use, and Emigration Canyon with its restaurants and lodging facilities. Parley's Canyon, which serves one of the valley's primary transportation corridors (I-80), also has golfing and camping facilities and is heavily used

Table 3-2
VEGETATIVE COVER AND LAND USE (1988)
Salt Lake County

Cover/Use		Area (acres)	Percent of Total Area
Barren rock		5,700	1.1
Alpine, conifer and aspen		76,500	14.8
Oak		87,700	15.3
Mountain brush, juniper, sagebrush and greasewood		62,400	12.1
Scattered native vegetation		79,700	15.5
Riparian, marshlands and wetlands		28,100	5.5
Open water (Incudes the Great Salt Lake)		15,000	2.9
Urban:	residential	92,800	18.0
	commercial and industrial	23,400	4.5
Agricultural:	irrigated	25,300	5.8
	dry-farm	18,600	4.5
	Total	515,200	100.00

Source: *Water-Related Land Use Inventories*, Division of Water Resources, 1994, and Division of Wildlife Resources data.

Table 3-3
LAND OWNERSHIP AND ADMINISTRATION

Status	Jordan River Basin (acres)	Utah Lake Basin (acres)	Jordan River/Utah Lake Basin Total (acres)
Private	372,800	866,400	1,239,200
State	33,600[a]	233,900[b]	267,500
Federal	108,800	844,800	953,600
Total	515,200	1,945,100	2,460,300

(a): Includes bed of the Great Salt Lake (b): Includes bed of Utah Lake

Figure 3-3

LAND OWNERSHIP

Jordan River Basin

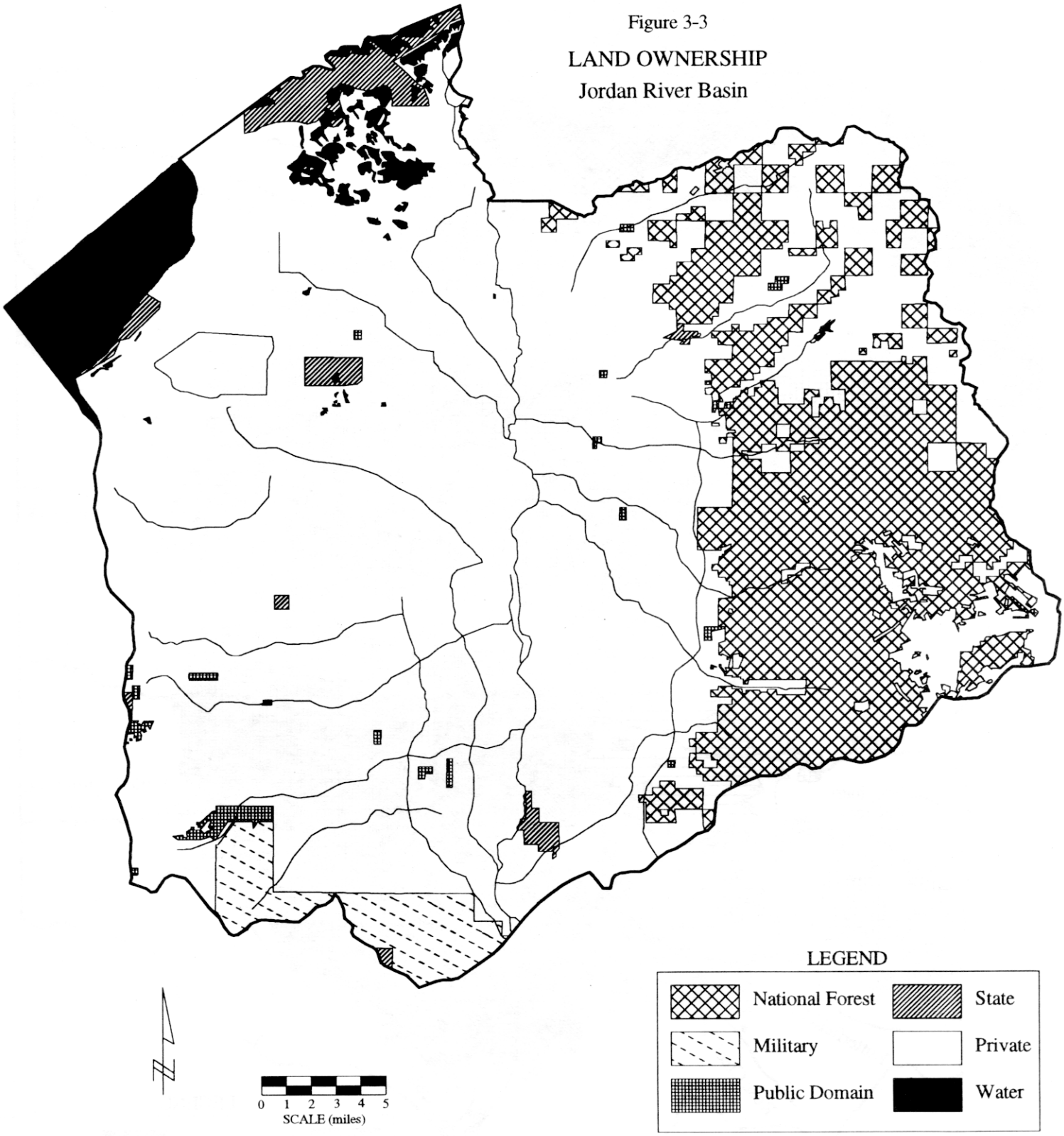
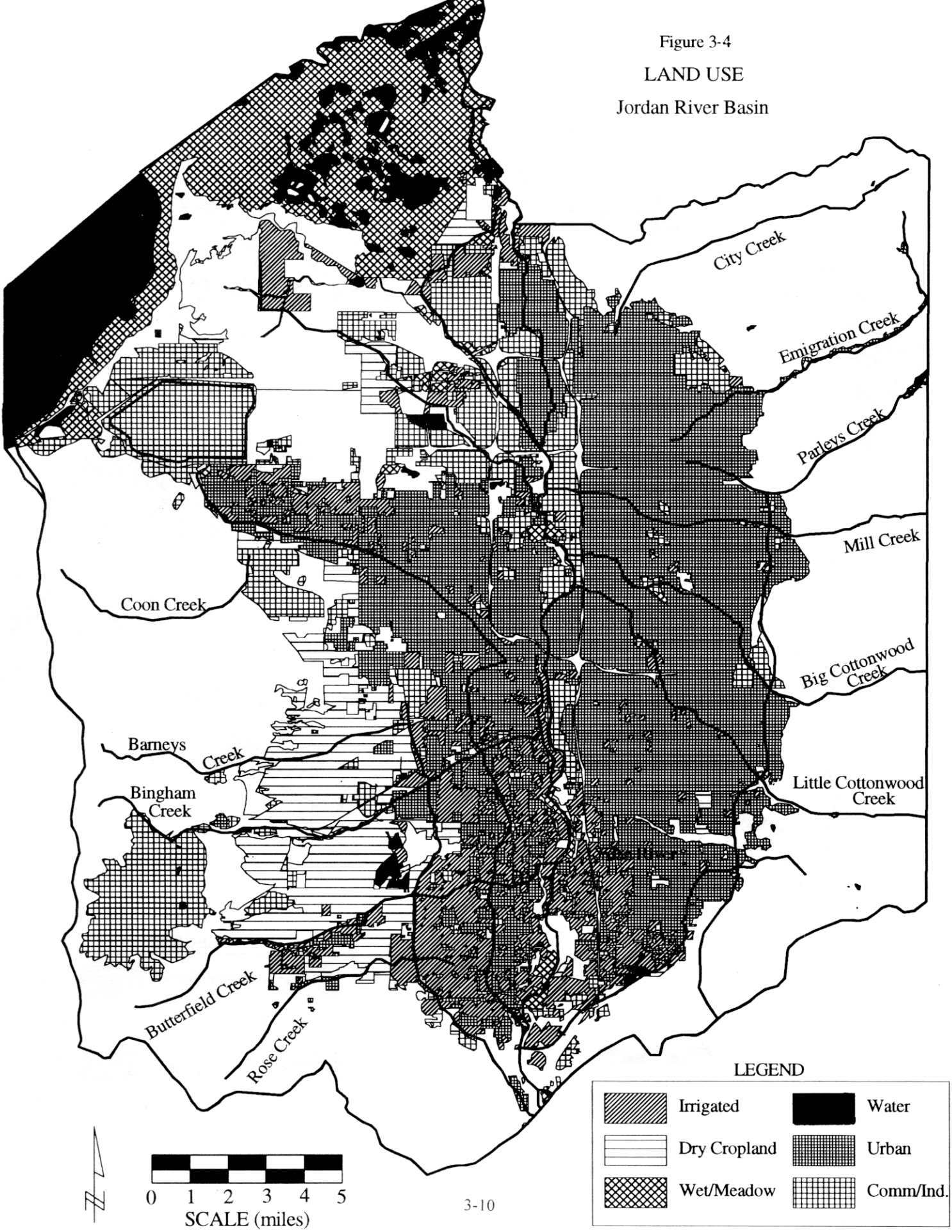


Figure 3-4

LAND USE

Jordan River Basin



for recreation and transportation. Most of the Wasatch Front Canyons as well as the mountainous areas, despite their rugged nature, receive fairly heavy usage for hiking, and other outdoor related activities on a year-round basis.

The land use data shown on Figure 3-4 reveals that residential lands are clustered primarily on the eastern half and central portions of the valley. Industrial lands are fairly well scattered throughout the valley with the most significant cluster in the northwest. Agricultural use is located in the southern and southwestern portions of the valley with some irrigated acres in the northwest. Conversion of irrigated agricultural ground to residential use, primarily at the southern end of the valley, is the current trend.

3.4 Water-Related History

The history of water development and use in the Jordan River Basin covers a period of nearly 150 years. Initial water use was primarily to irrigate land to grow crops; only small amounts were diverted for culinary or community use. This has changed over the years and now the major demand is for municipal and industrial uses. The changes that have occurred are very complex and only a brief summary is given here.

3.4.1 Pioneer Developments

The main body of Mormon Pioneers arrived in Salt Lake Valley on July 24, 1847. An advanced company of men arrived two days earlier to prepare land for planting crops. Water was diverted from City Creek and conveyed in ditches to irrigate land near where the Salt Lake City and County Building now stands. By the spring of 1848, over 5,000 acres had been brought under irrigation. By 1850, farming communities had been established on Big Cottonwood Creek, Mill Creek, Little Cottonwood Creek, Parley's Creek, Emigration Canyon and along the Jordan River. During this period, many ditches and canals were constructed to divert water from streams entering the valley from the east and from the Jordan River. Some of these are in use today. Ditches were financed and built by those who used the water and owned the land.

By 1860, practically all of the waters of the mountain streams had been appropriated for agricultural uses and by families dependent upon farming for their livelihood. Salt Lake City was almost entirely dependent upon City Creek, and the need for additional water resources was recognized. As early as 1864, Salt Lake City began looking into "boring artesian wells" and bringing water from Utah Lake and/or the Jordan River to the city.

Construction on the Jordan and Salt Lake City Canal was completed in 1882 and Jordan River water was brought to Salt Lake City. While this water was adequate for irrigation of crops, it was not suitable for domestic use. This led to the first "Exchange Agreement" in 1888 whereby Jordan River water was exchanged for a higher quality water from Emigration Canyon and Parley's Creek. Over the years, many other water exchange agreements were made in the valley. In 1892, Utah Lake was developed into a storage reservoir which made more water available in the Jordan River. From then, until about 1920, very little was done toward the direct acquisition of new water resources. Several small reservoirs were constructed including Mountain Dell Reservoir in Parley's Canyon which was enlarged in 1925 to a water capacity of 3,086 acre-feet.

3.4.2 Federal Projects

For many years the Bureau of Reclamation, in cooperation with the state of Utah, had been involved in the planning and development of water supplies for local sponsors in the Jordan River Basin. In 1931, the first complete report on the Provo River Project, which was the largest unit of this general plan, was presented by the bureau. Construction of the Provo River Project began in 1938 and the first water became available in 1941. Major features of the project eventually included completion of Deer Creek Dam and Reservoir (152,600 acre-feet) in 1941, construction of the Duchesne Tunnel, enlargement of the Weber-Provo Canal, enlargement of the Provo Reservoir Canal, and construction of the 42-mile Salt Lake Aqueduct in 1951. This aqueduct delivers water from Deer Creek Reservoir to Salt Lake City.

Construction began in 1967 on the Bonneville Unit of the Central Utah Project, and initial delivery to Salt Lake County began in 1990. This project is managed to provide a supply of 84,000 acre-feet of water in times of drought and an average annual 70,000 acre-feet of municipal and industrial water. The Corps of Engineers completed the Little Dell project in 1993. The Little Dell Reservoir has a water capacity of 20,500 acre-feet and serves as a flood control and municipal water supply.

3.4.3 Water Districts

The Metropolitan Water District of Salt Lake City was formed in 1935 by the Utah State Legislature as a "separate and independent" public agency. It is the primary wholesaler of water to Salt Lake City, which has a statutory preferential right to purchase all of the district's water for use within the city. The district participated in the Provo River Project and holds shares of stock in the Provo River Water Users Association which entitles it to receive 61,700 acre-feet of water annually from Deer Creek Reservoir. In 1990, Sandy City formally applied for annexation into the Metropolitan Water District of Salt Lake City. The MWDSLC's board of directors approved this request and increased the board membership from five to seven, adding two members to represent Sandy City. The Salt Lake County Water Conservancy District was organized in 1951 to supply water to the developing areas of the county. Water was first delivered in 1954. The district has grown over the years and now supplies water to 20 wholesale customers and over 7,500 retail connections which include all cities and fire improvement districts. Water sources include direct flow rights in the Provo and Weber rivers, local Wasatch mountain streams, groundwater and storage in Deer Creek, Jordanelle and Echo Reservoirs.

3.4.4 Jordan River History

Before settlement of the Salt Lake Valley, the Jordan River meandered from its entry into Salt Lake Valley at the Jordan Narrows across a broad floodplain to the Great Salt Lake. A forest of cottonwood trees traced its path along the valley floor. Numerous oxbows, marsh areas and riparian zones provided home to a diverse community of wildlife. The Jordan River reportedly was an excellent fishery in the early years following the first settlement of the valley. Since that time, the forest has been cut, the river channeled, the water polluted, the oxbows and wetlands filled, and much of the wildlife displaced. A considerable amount of pollution resulted from mining operations in the Wasatch Front canyons and the Oquirrh mountains. These mining activities have affected water Jordan River quality since before the turn of the century. But mining was at a peak from the early to middle part of this century. While some short sections of the Jordan River may have been straightened or channelized at an earlier date, the bulk of the Jordan River channelizing occurred during the 1950s and 1960s under the concept that a channelized river was the best method for handling flood flows. ■